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AGRICULTURAL MEMORANDUM NO 521

FORECASTING THE ENGLISH WHEAT ACREAGE EIGHT MONTHS AHEAD USING DWR DATA

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MAFF Technical Bulletin No 24 gave details regarding the estimation of the return to field capacity date in the autumn. Subsequent papers published in ADAS Quarterly showed

(a) the mean return date corresponded with the distribution of wheat

(b) the variation in wheat acreage was closely correlated with variation in return date.

(c) the wheat acreage could be estimated from return date data.

The return date depends on the soil moisture deficit at the end of the summer and the subsequent rainfall. An attempt was now made to forecast the wheat acreage (in the June returns) from the soil moisture deficit at the end of September, calculated from DWR data.

Fourteen stations were used and allocated to county areas as follows:

DWR Station	Counties	1969 Farmland (1000 acres)	1969 % Cereals	Mean % Wheat 1960 - 69
Leeming	Northumberland; Durham; N.R.	1702	33	13.5
Ringway	Lancashire Cheshire; Derby	1417	19	22.5
Finningley	Nottingham; Kesteven; W.R.	1702	42	30.0
Kilnsea	E.R. Lindsey	1454	57	29.3
Shawbury	Salop; Stafford; Hereford	1618	26	31.3
Elmdon	Warwick; Worcester; Leicester	1187	37	37.2
Wittering	Holland; Hunts; Northants; Rutland	1059	50	44.7
Honington	Cambridge; Essex	1106	59	43.0
Wattisham	Norfolk; Suffolk	1713	57	27.8
Filton	Somerset; Oxford; Gloucester	1744	28	27.4

DWR Station	Counties	1969 Farmland (1000 acres)	1969 % Cereals	Mean % Wheat 1960 - 69
Boscombe	Wilts; Berks	935	45	25.4
Cardington	Beds; Bucks; Hertford	835	50	32.5
Hurn	Dorset; Hants	985	38	20.7
Gatwick	Surrey; Sussex; Kent	1292	35	31.0

The counties of Cumberland, Westmoreland, Devon, Cornwall, with very small wheat acreages were omitted.

Although the choice of stations was dictated by their presence in the DWR, and not selected as typical of the area allotted to them, it was found that in areas with a high proportion of cereal growing (wheat, barley, oats, mixed corn, rye and fallow) the correlation between the percentage of cereal acreage in wheat and the September 30 soil moisture deficit was high:

Honiington	Cereals 59%	Correlation 0.73
Wattisham	57%	0.71
Kilnsea	57%	0.74
Cardington	50%	0.80
Wittering	50%	0.86
Finningley	42%	0.90

The lowest correlations were for Boscombe Down and Hurn, covering the counties Wiltshire, Berkshire, Dorset and Hampshire. It may be significant that these comprise a large proportion of chalk soils.

The mean national September deficit (d) was found by weighting the values of each station by means of their wheat acreages in their allocated counties.

The correlation between such mean values and the national wheat percentage over the years 1960 - 69 then was found to be 0.92.

Percentage of cereal acres in wheat = $24.46 + 1.52d$.

Results: Previous Year

Year	Mean 30 Sept deficit	Estimated %	Actual %	Error
1960	5.0	32.1	31.4	+0.7
1961	2.3	28.0	27.3	+0.7
1962	4.1	30.7	32.6	-1.9
1963	2.6	28.4	27.2	+1.2
1964	3.1	29.2	29.5	-0.3
1965	4.5	31.3	31.8	-0.5
1966	0.7	25.5	26.9	-1.4
1967	2.5	28.3	27.4	+0.9
1968	3.1	29.2	28.8	+0.4
1969	0.1	24.6	24.4	+0.2

Considering that no account has been taken of autumn or spring weather a forecast made of the June returns at the beginning of the previous October (8 months ahead) with a mean error of 0.8% in a range of 8% is encouragingly accurate.

Actual Wheat Acreage

To estimate the wheat acreage, account has to be taken of the change in total cereal acreage. This appears to consist of an increase from 1961 to 1966, with little change either end of the decade.

The following formula was derived (in 1000 acres)

$$\text{Wheat acreage} = 1435 + 125d + 100n$$

where d is the mean 30 September deficit and n is number of years after 1961 (with a maximum of 5).

Results:

	Wheat acreage (1000 acres)		
Year	Estimated	Actual	Error
1960	2060	1987	+ 73
1961	1722	1715	+ 7
1962	2048	2127	- 79
1963	1960	1823	+137
1964	2122	2093	+ 29
1965	2397	2409	- 12
1966	2022	2150	-128
1967	2247	2200	+ 47
1968	2322	2306	+ 16
1969	1947	1947	0
		Mean	53

The 30 September mean deficits for the last four years have been 3.9, 3.9, 3.4 and 3.7 respectively which suggests a fairly constant wheat percentage of about 30%. The wheat acreage for the 1970 returns should be about 2422,000 but without knowing the changes in total cereal acreage since 1969 forecasts for subsequent years might be misleading.

Any comments or suggestions on this paper should be referred to the author.

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